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Can law impose competition? A critical discussion and evidence from the Turkish electricity generation market

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ABSTRACT

Electricity markets have undergone regulatory reforms since the early 1980s around the world. Technical analyses of these reforms usually pay lip service to the influence of politics over regulatory processes. Existing studies examine certain aspects of the market such as demand, pricing, and efficiency, and they touch upon political issues only passingly when economic models cannot provide sufficient explanation. This approach problematically takes politics as an *ad hoc* variable. This study shows that electricity is intrinsically a 'political good' and argues that any meaningful reform effort should take institutions as the starting point rather than a residual. The argument that politics has to be an endogenous variable in any model aspiring to explain behavior in electricity markets is demonstrated in the paper. The evidence for the political good character of electricity is found by examining the Turkish regulatory reform, for which it is argued that there is not a satisfactory relationship between expected and realized gains.

Contents

1. Introduction

Electricity markets have been organized as public monopoly for a long time due to the perception that electricity has the characteristics of natural monopoly. However, with the turn of the tide towards liberalization of the markets in both the developed and the developing world, since the 1980s, many countries have undertaken regulatory reforms in electricity markets to enhance competition and efficiency. These reforms aimed to achieve these targets by institutional restructuring in the market by introducing various ownership schemes including privatization and transfer of operating rights to the private sector. Electricity market reforms in many countries have been subject to a myriad of economic studies.

Technical analyses of electricity market reforms usually pay only lip service to the influence of politics over the regulatory processes. A typical study looks into some aspects of the market such as market demand, pricing, concentration ratios and industrial performance parameters. They refer to political issues, but only passingly in order to show that there is more to the process than economic models. However, these approaches have a basic predicament. They take politics as an *ad hoc* variable. However, electricity is intrinsically a political good [24]. Politics has to be an

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endogenous variable of any model that aspires to explain behavior in electricity markets.[2]

Following Spiller and Tommasi [29], the present paper argues that the combination of three features makes electricity a political good: to begin with, electricity supply requires large specific and sunk investments; second, economies of scale and scope shape production processes; and finally, the product is consumed by the society.[3] Spiller and his coauthors usually describe this as an example of government expropriation of private firms. As an interesting case, the paper argues that rent transfer takes another direction in Turkey; rents are transferred from consumers to producers and the government as the intermediary.

The early history of the electricity industry is full of examples where some kind of state involvement was deemed necessary (e.g., [23,27]). It was widely accepted that electricity markets could not be left to supply and demand forces for economic reasons such as natural monopoly. Another major issue originates from the information asymmetries between the regulator and the industry. Regulators get their data from producers, and there is plenty of room to maneuver and manipulate what goes from the industry to the regulator. Furthermore, continuous interaction between the regulator and the industry reduces the cost of rent-seeking. The likelihood of political rent seeking and regulatory capture reduces the costs of asymmetric information for the industry but increases social welfare costs.

The traditional understanding of the state as an entity that supplies public services for the public benefit went hand in hand with the market failure arguments that showed strongly that electricity could never be a competitive industry if left alone. The change of the thinking on electricity markets happened during the 1970s and 1980s. As a result of political, economic and technological changes, competitive markets in electricity became more viable [27].[4] The first radical restructuring program started in Chile and many others followed the trend [21]. Even though reforms differ across countries, two main themes dominate agenda: increasing the level of private enterprises and reducing the role of state-owned ones.

The level of success of these reform efforts differed considerably. A few countries were successful in reaching the goals of the reform. Many, on the other hand, could not attract private investments and the state remained as a major player ([17], p. 463).

In the literature there are not many empirical studies on the connection between political environment and theoretical findings of economic models. Among those existing few studies incorporating political aspects such as Bergara et al. [6], Ando and Palmer [3], and Buckland and Fraser [9] tend to quantify the political influence on the market using proxy variables such as indices developed to measure the quality of political and judicial institutional environment and dummy variables representing the political tendencies of the states or countries. An important finding of the aforementioned studies is that the political institutions have been generous in providing excess returns to private electricity utilities. However, to explain behavioral patterns of electricity markets, the connection between political and economic factors has to be taken together. The experience of liberalization in many countries shows the absence of strong link between economic reform proposal and the realized market structure. Pure economic and political models usually disregard key findings of the other.

This paper aims to draw attention to this gap in interdisciplinary studies and focuses on the connections and tensions between political institutions and the logic of economic reforms.[5] The paper looks into the recent Turkish experience of regulatory reform in the electricity industry. Regulatory reform in the Turkish electricity market has been under way for about a decade and political factors have a strong influence on the reform process despite the existence of an independent regulatory agency in the energy market. In what follows, the Turkish experience is examined and it is shown that the argument that the economic foundation of the regulatory reform is rather weak and political considerations are more decisive, which provides evidence for the above-mentioned argument that electricity is a 'political good.' The political nature of decision-making is particularly strong in economies where the legal structure of the regulation is not well-defined and established (e.g., [14]). Nonetheless, the argument in this paper is not limited to the recently liberalized economies. By nature, economic tariff and structure of electricity industry cannot explain trends in the behavioral patterns in these markets [24,28].

In reality, a satisfactory relationship between expected and realized gains from the reform is not easy to establish. Any meaningful reform effort has to take institutions as the starting point, rather than a residual explanation as is usually done in technical studies. The evidence on the existence of the connection between political and economic factors in Turkey's recent restructuring effort in the electricity market is demonstrated.

The paper proceeds as follows. In the next section, an outline of the current regulatory environment is provided; the third section discusses the effects of the restructuring efforts in the Turkish electricity industry; finally, the fourth section wraps up and evaluates the long-term effects.

2. The basic regulatory framework in the Turkish electricity market

A number of factors initiated the restructuring of the Turkish electricity markets. To begin with, there were domestic issues such as the lack of investments in the industry and inefficiency of state enterprises. Secondly, there were foreign pressures for a regulatory reform. The European Union had started to liberalize its electricity markets in the 1990s with a series of reforms. Following many developed and developing countries, Turkey began its restructuring effort in 2001 with a new electricity market law (EML). It aimed to improve the efficiency and financial viability of the electricity market.[6] An independent regulatory agency, the Energy Markets Regulatory Agency (EMRA), was founded to oversee the market.

The law had a timetable for the introduction of competition in the industry. The first article of EML limits the role of the market to the 'delivery of sufficient, good quality, low cost and environment-friendly electricity to consumers'. This goal gives the regulator authority and will to intervene the market where and when it deems prices are out of proportion with these characteristics.

[2] The new institutional economics sees this as the basic characteristic of utilities in general. However, the change in technology and institutional environment helped to create a relatively competitive market structure in some industries such as mobile phone services.

[3] See also Holburn and Spiller [17]. They do not call it 'a political good'. This definition is preferred in this paper, as decision-making processes in this industry are shaped by political considerations rather than economic preferences.

[4] Recent experimental literature also provides some ground for liberal electricity markets. See, for example, Rassenti and Smith (2008).

[5] OECD's regulatory reform proposals and studies in this connection can be given as a major example of this attitude. See http://www.oecd.org/topic/0,3699,en_2649_34323_1_1_1_1_37421,00.html. For a general discussion on Turkish regulatory reform, see Çetin and Oğuz [12].

[6] For general discussions of the Turkish electricity market, see Bağdadioğlu [4], Çetin and Oğuz [11], Güney [16], and Oğuz [24].

Similar preferences can be found in the US and the European Union in phrases like 'just and reasonable' and 'fair' [28].

However, the goal of introduction of competition was not practical and attainable.[7] A basic problem of the timetable was that it did not take institutional and political factors into account [5,11]. In 2004, the government put aside some aspects of the law with a new strategy plan for electricity with a new timetable, which was not a realistic one either.[8]

Following the reform effort and the enactment of the new law, privatization and liberalization dominated the political agenda in electricity markets. The government wanted to increase supply and reduce costs, and prices later. A liberal market system was deemed the correct mechanism to reach these objectives. The generation segment was thought to be the most feasible for competition. Having neglected the political dimension of the industry, this idea failed. One institutional problem was injected to the system in the beginning. As in many developing countries long-lived sunk investments required guaranteed certain levels of return.[9] To overcome this issue, when the EML was enacted, government offered existing producers take or pay contracts. This created an important impediment to the establishment of competition and provided a strategic advantage to incumbent producers. The new market design did not address this issue.[10]

Existing contracts were seen as a transient issue in the beginning. The model assumed that as the market develops these contracts will not have much influence on the institutional structure. However, beginning with these contracts created a major hurdle in creating a competitive environment. The old model with long-term contracts did not have issues such as opportunistic behavior and market power problems. The experience from other countries shows that neglecting transactions costs issues usually create more problems in the future and make existing problems institutional ([20], p. 527).

It is possible to design an optimal pricing model for electricity under the assumption that the institutional framework is exogenous and has no effect on pricing and other decisions in the market. However, electricity is a political good before it becomes an economic good. Governments cannot afford blackouts and shortages of electricity for the sake of economic efficiency. Competition policy is also not very successful in energy markets. Put differently, efficiency is not a dominant goal for politicians. It is only secondary to political preferences.[11] As another characteristic of the political nature, consumers are quite sensitive to price changes. Governments do not want to allow prices to fluctuate without restraint. In the end, political regulation dominates. A real world example of this risk is to be found in the events in the wake of the California energy crisis [10,19].

Turkey's regulatory reform followed the general trend around the world [20]. Generation is deemed potentially competitive [5]. The legal structure aims a competitive generation segment. Transmission system is thought to be a state monopoly. Government owns the grid and the company. Distribution is thought to be a natural monopoly. Distribution regions are privatized and tightly regulated. Retail segment is thought to be potentially competitive, yet its privatization will take some more years to be realized.

3. Is the reform working?

The goal of any regulatory reform is to increase supply and efficiency, and reduce prices. A comparison of prices, market power and entry before and after the reform would provide a ground to measure its success. These are not the only variables to measure efficiency gains. By including political and institutional factors, the paper attempts to show the inadequacy of the pure economic approach.

Many factors influence the restructuring effort. Input prices, changes in the institutional structure and other variables play some role. However, the goal of the regulatory reform was explicitly stated as creating a competitive market and protecting consumers in the EML and other policy documents.[12] While it is difficult to measure the effects of reform in many countries, Turkey provides a good case in terms of the chosen variables in this paper.

Incentive mechanisms in the market influence the outcome considerably. While regulators tend to emphasize the regulatory power of the market forces, political preferences aim to protect consumers from higher prices. This creates a tension between the goals and motivations of stakeholders. The conflict of interest among competing institutions brings the issue of commitment to the forefront in understanding regulatory processes.

The following subsections look at the Turkish experience. The prices, market power and market entry in order to see the effects of regulatory reform in the industry are examined.

3.1. Prices

The theoretical literature suggests that prices should decline after the regulatory reform. Empirical literature finds conflicting results [18,2].[13] In many countries, liberalization (and regulatory reform) usually brings higher prices. Optimal pricing models fail to explain the systematic increase in prices after liberalization. Increased efficiency in the electricity industry (from generation to retail) after restructuring is a common expectation [15]. Also, another claim is that a regulatory model makes it easier to transform efficiency gains into lower prices as compared to state-ownership. However, the transition from lower costs to lower prices is usually not a smooth one.

The EML aims to establish fair and reasonable prices in order to protect consumers. Since the meaning of 'fair' price depends on value judgments and political environment, the government, via the ministry, plays a major role on prices.

In this section, the prices before and after restructuring are compared. The long-term effects on prices may indicate the effectiveness of the reform efforts. For example, in case of Europe, prices rose in since 2003 directives. According to the European Commission, high prices stem from cost differentials. While EC

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[7] The EU Directive of 2003 also specified a timetable for institutionalizing competition. It has not also worked perfectly so far. See Directive 2003/55/EC (2003 O.J. (L 176) 57).

[8] See http://www.oib.gov.tr/program/2004_program/2004_electricity_strategy_paper.htm for the Strategy Paper.

[9] These types of contracts have long been an important issue in liberalized markets from Brazil to Philippines. In many instances, as in Turkey, they were treated as exogenous to the regulatory model.

[10] An implicit assumption behind this approach is the disregard of vertical integration as an answer to transaction costs issues in the old model. As a result, the new, purely economic, model neglected the consequences of political transaction costs.

[11] In Turkey, when the possibility of excess demand increased for the near future, the government stepped back from liberalization and had a stronger control over the industry. The strategy paper of 2004, with its idiosyncratic characteristics, reflects the political nature of electricity markets.

[12] According to the first article of the EML, 'The purpose of this Law is to ensure the development of a financially sound and transparent electricity market operating in a competitive environment under provisions of civil law and the delivery of sufficient, good-quality, low-cost and environment-friendly electricity to consumers and to ensure the autonomous regulation and supervision of this market'.

[13] See Fabrizio et al. (2007) and Joskow (2008) for a recent empirical discussion of electricity markets. The difference between short-run prices and long-run prices may increase during restructuring periods. As it is discussed for the US markets (Fabrizio et al., 2007), efficiency may be related to the cost structure more often. Institutions make all the difference in this context as well.

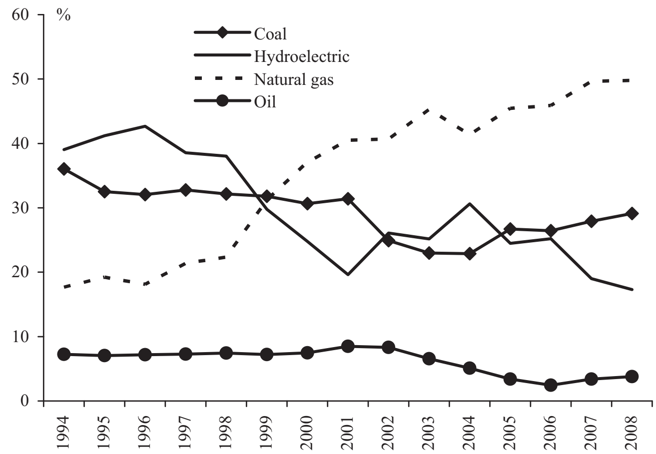


Fig. 1. Sources of electricity generation in Turkey.
Source: TEİAŞ.

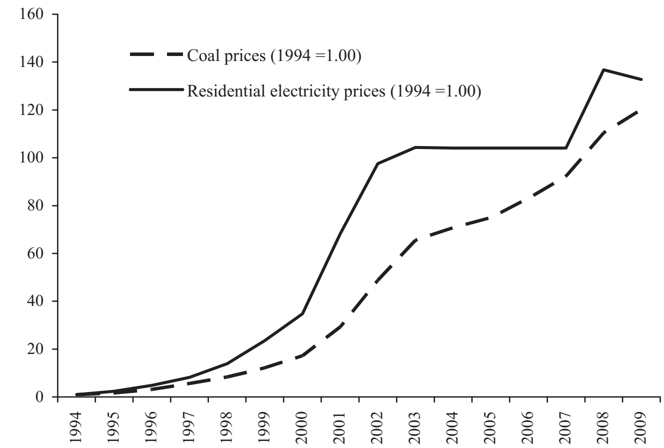


Fig. 3. Coal and electricity price indices (1994 = 1.00). Source of data: International Energy Agency and Turkstat.

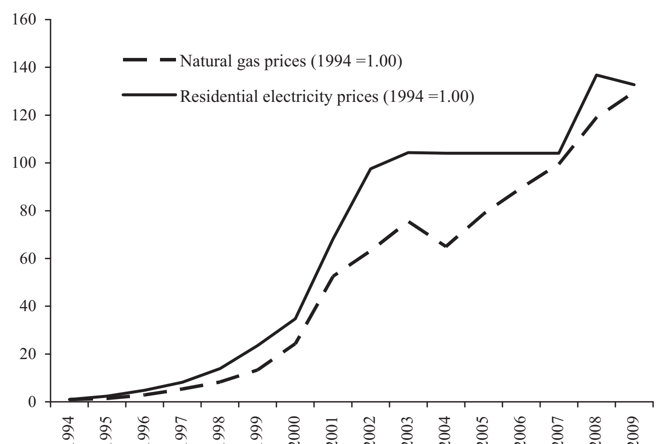


Fig. 2. Natural gas and electricity price indices (1994 = 1.00). Source of data: International Energy Agency and Turkstat.

accepts that inability to institutionalize competition has something to do with rising prices, its reasoning favors the 2003 Directive. It argues that prices rose because member countries did not follow the directive. Similarly, prices also escalated in the US markets after regulation. Rising prices drove some states to stay away from liberalizing electricity markets [28].

Electricity prices tend not to fall. However, in Turkey, prices remained low even though costs rose substantially. Many European countries raised electricity prices in the last decade considerably because of increasing input prices.[14] While these two observations seem conflicting, they refer to the role of political factors in electricity markets. No government can allow electricity prices to be determined by supply and demand only.

The price of electricity for residential users in Turkey should be directly proportional to the increases in the costs of natural gas and coal. A cost-based pricing model should relate input and output prices to increase efficiency. In Turkey, natural gas and coal are the major sources of electricity generation, recently accounting for about 80 percent of total generation cost, as shown in Fig. 1. It is noticeable from Figs. 2 and 3[15] that nominal electricity prices remained unchanged during 2003–2007 while the costs of coal and natural gas increased rapidly.

In Turkey, the current government, which came to power in 2002, kept electricity prices artificially low for a long time, even though input prices rose steadily. After the last elections in July 2007, which the incumbent party won with a wide margin, the price of electricity rose dramatically. The timing of hikes fits the existing theoretical literature on political behavior in energy markets. The government used electricity prices as an indicator of the success of its energy policy. In a sense, Paretian considerations prevailed until the elections. After the elections, Kaldor–Hicks concerns have become more important in terms of providing a sufficient level of electricity [24].

The first question to ask is who gains from regulation in comparison to state ownership. A regulated system reduces electricity costs of big consumers [13]. In Turkey, industrial customers pay lower rates than residential customers. However, the difference is lower than prices that reflect true costs of delivering electricity to each group. This works as a cross-subsidy from industrial customers to residential customers. The price difference between residential and industrial customers is much lower than many OECD countries ([16], p. 41). In 2005, the residential/industrial price ratio was 1.11. The ratio has not changed much since. The ratio is 1.18 in 2011 and still one of the lowest among International Energy Agency members.

Consumers of electricity do not have incentives to get informed about the electricity industry. They only care about prices ([28], p. 794). However, a small minority of the society, mainly producers, large consumers and regulators, understand the regulatory process and try to drive it.

The relation between elections and electricity prices can be observed in Fig. 4. Fig. 4 portrays the real electricity prices (i.e., nominal electricity prices deflated by the consumer price index) in Turkish Liras at 1994 prices. Large falls in real prices are mostly due to the large inflation in 1994 and in late 2000–early 2001 as a result of economic crises. The dates of the general parliamentary elections are 22 July 2007, 3 November 2002, 18 April 1999 and 24 December 1995. These dates are indicated by dashed lines in Fig. 4. In this period, real electricity prices for households increased to varying degrees after the elections except for 2002 elections. As stated above, the newly elected government deliberately kept the electricity prices low for political considerations after 2002.

Fig. 4 demonstrates an important relation between electricity prices and elections dates. A more elaborate analysis of data is necessary to see the exact nature of their relationship. For this purpose, the patterns in the movement of electricity prices over time are analyzed. Specifically, the structural breaks for the long-term trend in electricity prices are examined by using the cumulative sum of squares (CUSUM-SQ) technique. The technical details are skipped

[14] Marginal plant in many countries uses natural gas. Thus, the retail price depends on natural gas to a great extent.

[15] The prices of electricity, coal, and natural gas in Figs. 2 and 3 refer to nominal prices, indexed with 1994 as the base year (1994 = 1.00).

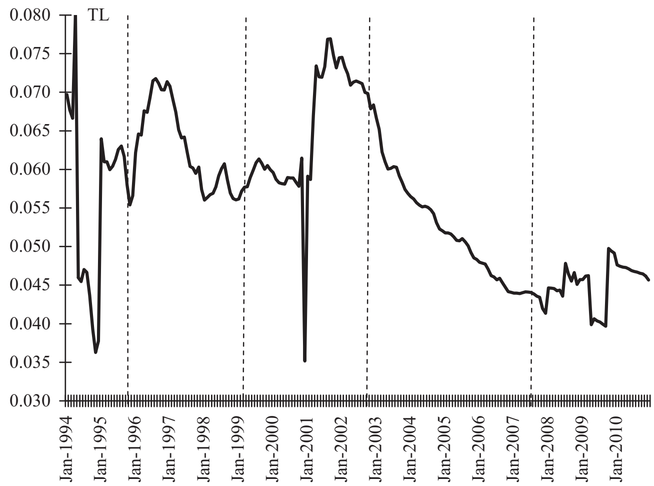


Fig. 4. Monthly real electricity prices.

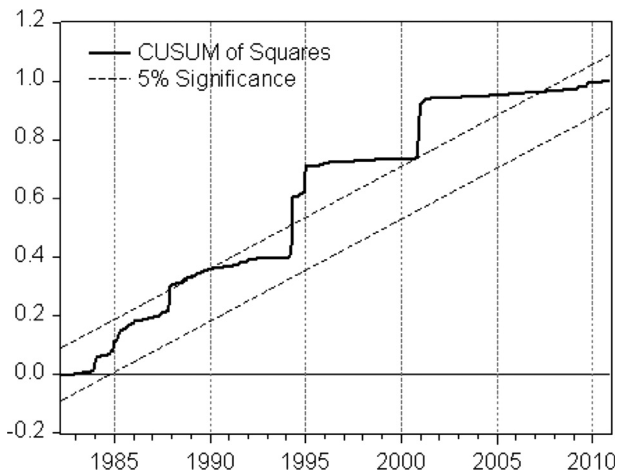


Fig. 5. Cumulative sum of squares.

for brevity; interested readers are guided to the Appendix A at the end of this article. Fig. 5 presents structural breaks during the period 1982–2010. The dashed lines represent the 95 percent confidence interval around the expected value of the CUSUM-SQ test statistic. Within these borders, real electricity prices exhibit stability. Structural breaks are detected by tracing the spikes. Since the test statistic lies outside the area between the critical lines, electricity prices were unstable from May 1994 to May 2007. This is reflected in artificial pricing of electricity during this period. The pressure on electricity prices was lifted after 2007 due to the need to attract new investments to cope with the projected supply shortages. The spikes occurred in January 1984, January 1985, December 1987, May 1994, May 1995 and December 2000. The spikes in May 1994 and December 2000 refer to the months immediately after the financial crises, and therefore reflect the stability measures taken by the government in the aftermath of the crises. The spike in January 1984 occurred two months after the November 1983 elections. The spike in December 1987 follows the elections in November 1987. On the other hand, no structural changes around the election months December 1995, November 2002 and July 2007 are observed. Even though structural breaks in those dates are not observed, prices are artificially determined during the period 1994–2007.

A major reason for higher prices after 2007 elections is that the restructuring has not brought considerable efficiency gains to the industry. Akkemik [1] finds that there has been some

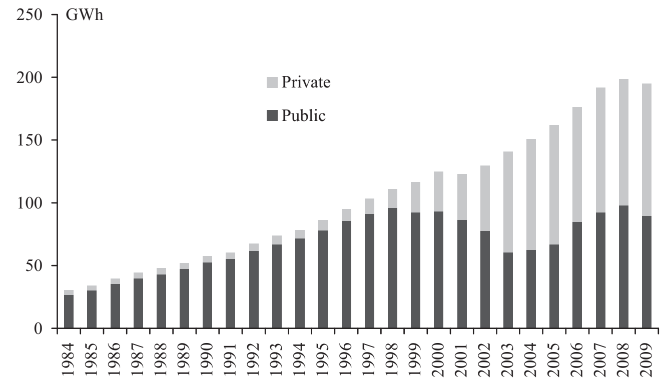


Fig. 6. Electricity generation by public and private facilities in Turkey. Source: TEİAŞ.

improvement in terms of overcapitalization and technological change in electricity generation. However, these gains have not found their way to consumer prices. The regulator (EMRA) has not been able to implement pro-market reforms that may reduce costs in generation, distribution and retail segments. The institutional problems of the industry played a major role in slowing down the impact of the reform. In many instances, the government preferred inefficient alternatives for political reasons [30].

Efficiency gains are obtained in the generation segment of the market. Suppliers mostly capture efficiency gains in the system. The government has chosen a hybrid-pricing model to provide some cushioning against risks for producers. The model also offers some incentives to improve efficiency with the revenue-cap model [31].

3.2. Market power

The change in market power is another facet to evaluate the success of the reform. Because of the necessity for large-scale production, market power exists in most generation markets. Companies tend to turn their economic powers into legal ones through political pressure and lobbying in many countries. In this process, prices rise beyond competitive levels.

Market power in generation arises for a number of reasons, including very low elasticity of demand, non-storability of electricity and geographical constraints [21]. The institutional structure of generation markets makes it easier for generators to coordinate their activities without being explicitly detected by competition authorities [7]. For example, when a generator stops producing, there may be many potential technical reasons in addition to monopolistic incentives or price-fixing activities.

The EML aimed to separate generation and transmission/distribution in Turkey. However, the progress has been less than designed. The state still dominates the generation segment. According to the officially published electricity statistics, the state electricity production company, EÜAŞ, and its affiliated partnerships owns around 45 percent of the generation capacity and realizes almost half of total electricity generation (46 percent) in 2009 (see Fig. 6). The transmission segment is a state monopoly. This environment provides room for governmental expropriation, by creating an impediment for pro-competitive actions.

The generation market has, and will have, an oligopolistic structure where companies will have long-term stable relationships most of the time.[16] The market has a tendency to be a natural

[16] A more complicated issue arises when generation and distribution are thought together. Electricity tends to be a regional rather than a national market. Regional market power will definitely be higher than national ratios. Prices will be affected from regional behaviors more than national policies.

oligopoly. In this environment, private and public generators will coordinate their activities when the market begins to stabilize.

A widely used indicator of the market power is based on the calculations of CR4 and CR8. In Turkey, CR4 for electricity generation was 49, 46.4 and 45.7 percent for the years of 2006, 2007 and 2008 respectively. The relevant figures for CR8 are 65.2, 60.3, and 61.7 percent for the same period.[17] These numbers show that market concentration was still high after 5 years of liberalization experience.

The EML puts a 20 percent cap for private generations in order to provide a competitive environment. No private generation company, with its affiliates, can own more than 20 percent of total installed capacity. However, this limitation does not apply to state generators. A close relationship between market concentration and prices is to be expected, especially when the government is the dominant player.

In European markets, there is a strong relationship between market concentration and price changes.[18] Concentration explains much of price increases. While there are not any similar studies for Turkey, the situation can be expected to be similar based on theoretical conjectures.

In the case of Turkey, big customers are able to go around the regulatory system by producing their own electricity as self-generators. As the cost of generation declines with technological improvements and the availability of relatively small-scale production at natural gas plants, companies turn to self-generation at a faster rate. Indeed many companies in Turkey have chosen this path. In practice, they buy electricity from the grid at off-peak times and produce their own electricity at peak times. This increases the cost of peak-hours electricity to residential customers. Another reason is generous tax incentives given to self-generators.

While market concentration falls, price changes do not correlate with CR4 or CR8. This supports the argument that economic factors alone do not determine prices in the industry. The exploitation of arbitrage opportunities by self-generators reflects the political decision-making process in electricity markets.

3.3. Market entry

There are economic potential and profit opportunities for new entry in the market. However, the current institutional structure will likely be a barrier to entry. The monopoly of the state electricity trading company, TETAŞ, and the dominance of EÜAŞ make it harder for new private companies to enter the market competitively. Yet, entrants will accommodate to the existing structure. Currently there are not many incentives to be efficient in the generation market. Producers have two options. They can sell electricity to TETAŞ with long-term contracts or sell their production in the spot market, which offer higher prices than long-term contracting. In both cases, the absence of excess supply allow generators to produce with inefficient cost structures, even though there has been some improvements in technical efficiency since the beginning of the reform in 2001 as documented by Akkemik [1].

There has been significant private entry into the electricity market in Turkey. Fig. 6 shows that the share of private generation facilities has increased largely with the start of the regulatory reform in 2001. However, public share has recovered and stagnated around a half since 2006.

An important issue is the differential treatment of new entrants. The competition policy should aim at creating a 'level playing field' for potential competitors as well. However, the current system favors incumbents. Incumbents have had a comparative advantage since the introduction of current framework.

The state transmission company, TEİAŞ has a legal obligation not to discriminate between equal parties. It is required not to distort competition both in generation and distribution segments. However, TEİAŞ sometimes discriminates between state generators and private ones.[19] A potential remedy of this problem is the introduction of the secondary market for transmission capacity.

An indirect way of new entry is of self-generators. They can sell up to 20 percent of their production to the market, without obtaining a producer license. There is a strong demand to be self-generator. This also creates unhealthy incentives and consequences for the market. The reason for this is not an inherent problem with self-generation. Rather, it has much to do with ill-designed generation model where self-generators are able to manipulate the system and use it to extract rents.

4. Discussion

In this paper, the connections between political institutions and the economic factors during regulatory reforms were examined by taking the recent reforms in the Turkish electricity market as an example. The main finding of the paper is that electricity can be regarded as a 'political good' and political considerations overwhelm economic reasoning in the determination of prices. The paper found further evidence for the political good character of electricity from market power and market entry in the electricity market in Turkey.

In terms of long-term effects, it is necessary to look at how the investment decisions of private investors change. An important factor for long-term effects is cost structure. Whether the reform brings costs savings is a crucial indicator of the success of the reform. In the case of the Turkish electricity market, the regulatory reform is approaching a crossroads where economic considerations and political preferences will have to confront each other openly. Economic and political costs move in opposite ways. If economic costs are to be reduced, political costs would increase. If political costs are to be reduced, the cost of producing electricity would increase.

A basic issue is there is no clear link between method of restructuring and the success of reforms. Designing 'optimal' restructuring models do not help to solve basic issues in electricity markets ([17], p. 464). Put differently, pure economic models fail in explaining what is happening in the electricity industry.

Another dimension of the issue is the volatility of prices. Since the California crisis, governments are alert to excessive movements in electricity prices. Some argue that, electricity prices are by their nature volatile and the volatility will not diminish as the market matures [22]. There is also a trade-off between short-term price volatility and long-term price reductions. It is impossible to get both at the same time. A competitive market would reduce volatility, if government regulation actively keeps prices higher and guarantee generators an acceptable return. If generators compete in a free market, prices will fluctuate and this is politically not feasible.

[17] The data are obtained from industry-level concentration statistics published by Turkstat (Turkish Statistical Institute) and are available only for these years.

[18] See the study by London Economics prepared for the European Commission, available at http://ec.europa.eu/comm/competition/sectors/energy/inquiry/electricity_final_part4.pdf (retrieved August 27, 2008).

[19] Price discrimination between state generators and private companies was the subject of a recent Competition Authority investigation. It was alleged that the state electricity distribution company, TEDAŞ, offered higher prices to the private company. The Competition Authority decided in favor of TEDAŞ. This issue is not unique to Turkey or to state-owned enterprises. Preferential access to the network is widely seen in Europe as well ([28], p. 787).

Many countries are stepping back from a free market in electricity generation and prefer a traditional regulation method. It is assumed that voters are not willing to take the risk of volatile prices. This trend toward a more traditional regulation also shows that the major issue is 'regulatory governance' in electricity. Governments usually cannot commit themselves to a particular path, after it is expressed. For example, EML includes a timetable for liberalization. However, the new government ignored the law and introduced a new timetable with a strategy paper. The reason for this opportunistic behavior is political. However, optimal regulation models, implicitly, and sometimes explicitly, assume that rules are exogenous to the behavioral patterns in the industry.

Market efficiency in electricity is sometimes seen as an idle fancy. If governments cannot impose efficiency through law in electricity and implement reforms successfully, a theoretical explanation is necessary. It cannot be simply explained by the unexpected economic conditions, or political behavior as an *ad hoc* rationale. Political factors are endogenous to electricity markets. Thus, any model that tries to explain decision-making process for electricity markets has to start by accepting that electricity is a political good.

Appendix A. Examination of structural breaks

To examine the structural breaks in real electricity prices since 1980, the cumulative sum of squares (CUSUM-SQ) technique, which is based on Brown et al. [8] and Quantitative Micro Software ([25], pp. 171–174), is employed. The CUSUM-SQ technique is based on the idea that if the residual variance of the dependent variable is stable with a 95 percent confidence interval, the parameter in question is stable.

For the CUSUM-SQ test, the recursive residuals are used. Recursive residuals are obtained from recursive least squares equations. Recursive least squares equations are estimated repeatedly, and in each round, the regressions equation uses a larger subset of the sample. If there are k coefficients, then in the first round, the first k observations are used to estimate the value of the dependent variable. In the second round, the first $k+1$ observations are used for the second estimate of the dependent variable, and so on. This process ends after all observations in the sample are used and a set of estimates of the dependent variable are obtained. In each round, the latest estimate is used to estimate the next value of the dependent variable. The forecasting errors obtained in this way in each round are called the recursive residuals. These residuals are computed for all points in time $t=k+1,\dots,T$.

The test statistic for the CUSUM-SQ test, S, is defined as follows:

$$S_t=\left(\sum_{r=k+1}^{t} w_r^2\right)\Big/\left(\sum_{r=k+1}^{T} w_r^2\right)$$

where w_r represents the recursive residuals. The expected value of S assuming that the parameter is constant is as follows:

$$E(S_t)=\frac{t-k}{T-k}$$

and

$$E(S_t)=0 \quad \text{if t = k}$$
$$E(S_t)=1 \quad \text{if t = T}$$

The departure of S_t from its expected value is assessed within a band of 5 percent critical lines below and above the expected value of S_t for each point in time $t=k+1,\dots,T$ as shown in Fig. 5. If the value of S_t lies outside the confidence interval band, this is indicative of parameter instability. Structural breaks during the sample period are detected by tracing the spikes or significant discrepancies of the value of S_t from its continuous trend.

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